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PLANT PROTECTION BULLETIN

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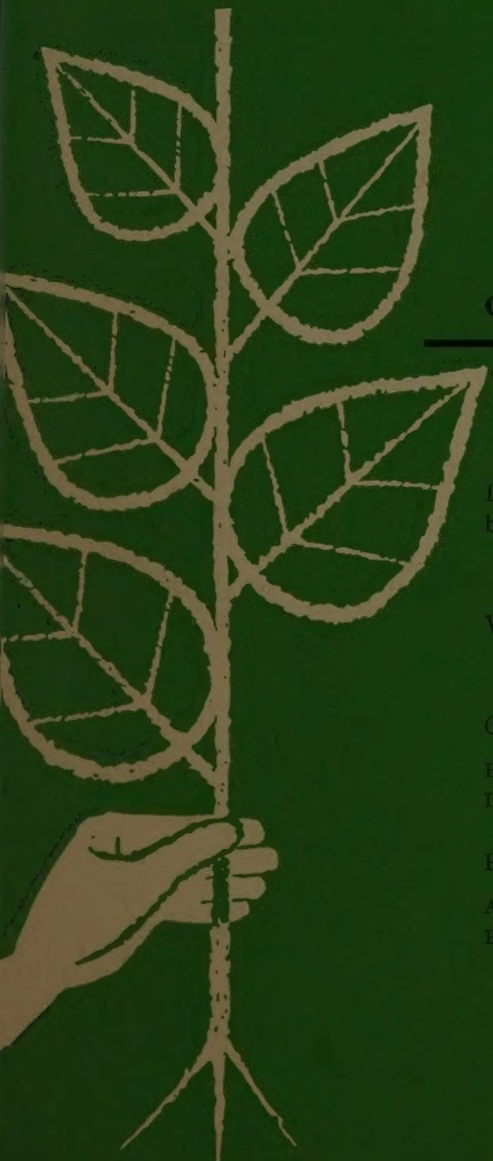
A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS



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FAO PLANT PROTECTION BULLETIN

A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

Insect pests and fruit spotting of Gros Michel bananas in Ecuador

Harold R. Yust, United States International Co-operation Administration, Lima, Peru

Insects are common on banana plants and fruit in Ecuadorian plantations. Some of these are known to cause serious damage and others are thought to be of little or no importance. However, because of heavy financial losses to growers due to fruit spotting, the fauna of insects in banana plantations is being reappraised to determine whether unsuspected insects are causative agents.

Some insect-plant relationships have already been established. Caterpillars such as those of *Ceramidia viridis* (Druce), *Caligo* spp., *Caerois gerdrudtus* (F.) and *Opsiphanes tamarindi* (Felder) feed on foliage ; the cosmopolitan root borer, *Cosmopolites sordidus* (Germ.), feeds on both the rhyzome and the basal part of the pseudostem ; the red rust thrips, *Palleucothrips musae* (Hood), and the cacao red-banded thrips, *Selenothrips rubrocinctus* (Giard.) feed on fruit surfaces, causing spotting ; the flower thrips, *Frankliniella parvula* (Hood), produces pimples and small water-soaked spots on the fruit peel ; the brown aphid, *Pentalonia nigronervosa* (Coqu.), feeds on various parts of the plant but especially causes water-soaked spots near the attached end and on the interior surface of fruits or fingers ; small bees, *Trigona* spp., are responsible for black scars on the ridges of fingers ; scale insects, such as *Aspidiotus destructor* (Sign.) and *Selenaspidus articulatus* (Morg.), make the surfaces unsightly.

The caterpillars are widespread and, during certain seasons, may feed heavily on the leaves, causing a serious reduction in fruit production. The root borer is unevenly spread in the plantations and may so weaken the plants that the fruit is inferior and greatly reduced in quantity. The red rust thrips occurs in very limited areas but the flower thrips is widespread in the banana-growing areas. The brown banana aphid is also present in most plantations.

During the early months of 1958, spotting was especially serious and was reported to be responsible for considerable rejection of fruit by inspectors. The matter has become very alarming to the growers. In general, the spotting is largely dark brown in color, varies in extent and is not understood by growers. It does not appear to influence edibility but it does cause the fruit to spoil more quickly and detracts from its appearance. Generally, the growers call the spotting *Mancha roja de trip*, referred to in English as " red rust of thrips." This is probably due to the fact that the growers first became conscious of fruit spotting through the publicity on red rust of thrips following the discovery of the red rust thrips, *Palleucothrips musae*, by the author. Hence, the growers use the expression *Mancha roja de trip* for most spotting.

Spots, stains and discoloration of bananas are due to many causes. Bruising is especially important but the discoloration mentioned in this paper appears on green fruit of Gros Michel bananas at harvest and before handling.

Often spots are within the fruit stock away from general abrasions and the usual external pressures. Confusion results because of the various kinds of spots and because spots of different origin are present on the same surfaces at the same time. The more important of these stains and spots on green bananas at harvest are : red rust of thrips ; maturity staining ; egg pimples of flower thrips ; spray spotting.

This paper discusses the spotting of banana fruit especially as related to insects and it includes other discolorations indirectly related to, or confused with, insect spotting. Its objective is to provide general information on this subject about which practically nothing has been written.

Red rust of thrips

This is a brown discoloration on the fruit peel, ranging from a light brownish-copper color to a blackish-brown with a purple tint. The discoloration results from abrasions of the tissue as a result of feeding by the red rust thrips, *Palleucothrips musae*. When the spotting is light, it often has a lacey appearance due to the aimless feeding trails of the thrips. As feeding continues, the peel is completely scarred, and where feeding is intense the rind turns a solid reddish-bronze, including the ridges. The spotted areas are slightly depressed in comparison with the level of the nonspotted peel and are clearly surrounded by a water-soaked border when freshly made. Often the scarred area cracks after drying. The discolored areas are generally irregular in shape and the entire fruit is usually not scarred. Discoloration is most common on the inside surfaces of the fingers or individual fruits, as located on mature stocks, or on the outside near the attached end where the next group of fruits provides protection. Generally, the worst discoloration occurs where two fruits are almost in contact, whereas the least is on the blossom end of the outside fruits. The discoloration is usually more abundant on the side of the fruit stock next to the trunk. It is also present on the side away from the trunk but it is difficult to see from the ground on the unharvested stocks. Cell walls are brown, as may be seen in surface slices of peel under magnification of 100 times.

Thrips feeding occurs only after the fruits turn upward tightly against the stock and thrips damage usually is not found until about two weeks later. By this time the stock is six or more weeks old. Generally, red rust is not severe until the stock is about two and a half months old or several weeks from harvest. Discoloration is apparent in a week after thrips feeding. Plantain (*Musa paradisiaca*) shows very severe thrips russeting and seems to be the preferred host.

Most red rust is encountered in areas of very dense shade, suggesting that damage can be reduced by decreasing plant population through spacing and pruning to permit the entrance of more light. The greatest amount of damage occurs during the period from July to December, which is the dry season in most areas, but it has been found throughout the year. Claims that red rust of thrips is most serious in some areas in April, at the time of heavy rains, seem contrary to the facts. Probably it is the result of mistaken identification of the spotting. Heavy red rust thrips populations have never been observed during periods of heavy rainfall, and usually they are not abundant even during favorable conditions. Hence, it seems likely that red rust thrips are neither directly nor indirectly involved in most of the spotting referred to as red rust of thrips.

The thrips causing the red rust damage are, except for black eyes, white to light cream color in all stages. They are very small and tend to be sluggish. All stages are found on fruit surfaces within the stock. Hence, they are usually not seen without cutting the fruit stock apart. They were discovered by the author on 2 August 1956 near Quevedo, Province of Los Rios, and at that time they were very abundant. He first observed the damage during September of 1952, shortly after his arrival in Ecuador. At that time it was said that the damage had been apparent for several years in restricted areas. Since then the thrips have been observed in Pichincha of Manabi Province ; La Isla, Milagro and Bucay of

Guayas Province ; and Valencia and Catarama of Los Rios Province. It appears that the red rust thrips is spreading and will continue to infest new areas.

Maturity staining

Maturity staining is characterized by long orange-brown to dark brown stripes of discoloration on the flat surface of the fruits. They may be on any or all of the flat surface but they never cross the fruit ridges. When serious, the stripes extend almost to the whole length of the fruit and about 1 centimeter in width. When not severe or just starting, the stripes are short and about the same width. Discoloration usually commences on the first two hands of fruit, at the butt end of the fruit stock, in about 100 days during the warm rainy season and 120 days during the cool dry period. Often the staining is in line on the fruit from butt to tip and it may be associated with occasional crooked or malformed fruits. This stain is almost invariably found on substandard fruit stocks not harvested at the regular intervals.

Under magnification it may be seen that the discoloration at first consists of light brown filaments lengthwise of the fruit and just under the surface in the peel. In time, the discoloration becomes solid and turns darker. Later, the surface dries and lengthwise cracks appear. During this period decided changes in general appearance take place and these result in considerable confusion in the minds of the field operators.

The staining may be confused with red rust of thrips by some growers and field workers, and much of the discoloration which is called red rust is really maturity staining. In some stages there is a close resemblance, and sometimes both are present on the same surface. However, the discolored areas are distinguishable by a trained observer with a hand lens, on the basis of the descriptions given above.

It is the opinion of specialists in banana culture that maturity staining is due to slow growing of the fruit. Generally, fruit stocks are harvested for the United States market in 90 days during the warm rainy season and in 120 days during the cool dry period. When growth requires more than 100 days there is usually a considerable amount of stain. Slow growth may be due to many factors or a combination of factors. The main factors are low temperature, insufficient moisture, poor drainage, shallow soils, inadequate fertility, overcrowding of plants and serious disease or insect attack. Banana root borer and caterpillars retard fruit growth, and it is thought that in this way both contribute indirectly to maturity staining, although there are no substantiating data. Some growers and specialists believe that maturity staining occurs as a result of very heavy shade, and while reduction in discoloration has been reported by decreasing plant density, this undoubtedly involves more than changing shade conditions.

Egg pimples of flower thrips

A small brownish-black pimple 1 to 2 millimeters in diameter is produced on the surface of banana fruits as a result of oviposition by the flower thrips, *Frankliniella parvula*. The discoloration is centrally located on the pimple and is due to the scab tissue at the point of insertion of the ovipositor. The dark spot is sometimes encircled with a ring of dark green tissue which disappears as the fruit matures. Sometimes the peel of the fruit becomes completely dark due to the abundance of egg pimples and the surface feels like sand paper.

Oviposition usually commences in young tender fruit 4 to 8 centimeters long and still enclosed in the flower cluster. In most cases, oviposition occurs when the stems are about six to ten days old, before the newly forming fingers are exposed, and it continues after they turn upward. There is a tendency for the pimples to be on the outer surface of the fingers as they are situated on mature stems, suggesting that the eggs are deposited on the inner surface before the fingers turn up. There is also a tendency for the pimples to be at the extremities of the fruits, which are more accessible when they are very small. The last four hands always have the greatest number of pimples. Up to 70 pimples have been counted on one surface of fruit 8 centimeters

long. At times they are very concentrated, with as many as 25 occurring per square centimeter. Additional data on the density of the pimples are provided by Merino.[1]

At present this is the most widespread and prevalent marking on banana fruits. It is usually mixed with all other types of spotting and creates confusion in the diagnosis of discoloration. When individual fruits are badly discolored, the entire stock of fruit is usually severely damaged but egg pimples do not usually result in rejection of fruit stocks.

The flower thrips appears to be the most abundant insect in banana plantations of Ecuador. The female is black or dark brown, about 1 millimeter long, abundant on newly forming stems, both on the small fingers and fertilized flowers. They can usually be found on the ground under new fruit stocks in the recently fallen flower parts. The male is whitish in color, measures about 0.9 millimeter, has black eyes and can usually be found on the growing bud on sunny days. Larvae of the thrips are abundant at the base and inside the fertilized flowers. These thrips probably have been in the country for a number of years because they are very well distributed. They are abundant throughout the year.

There are claims that the population has increased since spraying with toxaphene was started to control caterpillars, but this seems unlikely because the author observed high populations of this insect in plantations before spraying commenced and they can now be found in great numbers in nonsprayed plantations. No insecticide is applied to control this pest and, at present, it seems advisable for the grower to accept the losses and not to increase production costs by spraying.

Spray spotting

Spraying is now a very common practice in banana plantations in Ecuador to control the sigatoka disease caused by *Mycosphaerella musicola* Leach (*Cercospora musae* Zimm.) and the caterpillars previously mentioned. It is stated by Herrera [2] in 1958 that 84,362 acres of bananas were sprayed for sigatoka during the 1957-58 season. This is 22.6 percent of the total area planted on the basis of the most recent national agricultural census in 1954. The fungicide treatment most commonly used, according to Desrosiers,[3] consists of about 6 gallons of insecticide oil per acre applied every 14 days during the rainy season. The intervals may be increased during periods with less rain but there are usually about 15 applications per year during the period from December to end May. More recently the dosage has been reduced to about 10 to 15 liters per hectare. The applications during the 1957-59 seasons were about 46 percent by helicopter and airplanes and about 34 percent by portable power mistblowers.

The area sprayed for control of caterpillars is not known; although substantial, it is not equal to that sprayed for sigatoka. The caterpillar, *Ceramidia viridis*, which was reported previously by Yust and Cevallos,[4] is a very serious pest. When the population is high the leaf surface is completely consumed in a short time, leaving only the mid-vein and trunks, and rapidly eliminating fruit production. In areas where the insect is known to be serious, inspectors make counts from time to time to determine the need for insecticide applications. It is a pest only during the wet season and disappears when the rains stop. The insecticide most commonly used is toxaphene (emulsion form) at the rate of 0.8 to 1 pound of technical grade per acre. It gives adequate control on plantations with good inspection service. One to four applications are made, usually in the concentrate form. The same equipment used for sigatoka control is used to apply insecticide, and fungicide and insecticide

[1] Merino, M. G. 1958. Progresos alcanzados en el conocimiento del Trip de la flor del banano. *Prog. Agr.* 4(3): 3-5.

[2] Report for 1957-58 season by Ing. César Herrera V., director of the technical department of the National Association of Banana Growers of Ecuador.

[3] Desrosiers, R. 1958. El control de la Sigatoka en el banano Gros Michel por atomizaciones a bajo volumen en el Ecuador. *Min. Fomento y Producción Dir. Gen. Agr. Bol. Técn.* 1.

[4] Yust, H. R. and M. A. Cevallos, G. 1954-55. Lista preliminar de plagas de la agricultura del Ecuador. *Rev. Ecuad. Ent. Par.* 2(3-4): 425-42.

are mixed when needed at the same time.

Spray spotting or burning of fruit has been definitely established in various locations. Spotting will invariably occur on fruit if droplet size is larger than 150 microns, irrespective of concentration or frequency. The spots are usually brownish-copper-colored, more or less round in shape, and vary greatly in size. Some are only 1 or 2 millimeters across and the larger ones usually do not exceed 1 centimeter in diameter. The discoloration may be seen developing on spots which have the wet appearance of oil and is apparent the second day after application. The spots are more inclined to be on the outer blossom end of the fruits but some are also found on the inner surfaces. This may be due to the position of the fruits when the spray is deposited.

The nature of the phytotoxicity is not completely understood. Spotting seems to be associated more with the use of toxaphene for caterpillars than with the use of oil for sigatoka control. The toxaphene solvent appears to be responsible for the burning. Careful control of droplet size results in very little, if any, burning. Some spray burning which has been found in unsprayed plantings adjacent to those being sprayed from the air has been traced to dripping due to poor shutoff devices during turning. Inadequate supervision of air applications, resulting in respraying of the same rows, is also responsible for some damage. Burning invariably results when the atomized stream of concentrate spray from a knapsack-type power mistblower is pointed directly at young or half-grown fruit stalks.

Red spot of red-banded thrips

The spotting commences with a silvery discoloration which eventually changes to a dark reddish-brown color. Such spots are not depressed nor are they surrounded by water-soaked borders. They are not as large as the ones resulting from feeding by the red rust thrips and are mostly on the outer surfaces of the fingers as situated on the stock. The red-banded thrips, *Selenothrips rubrocinctus*, is very common on cacao and is present in banana plantations where there are cacao interplants.

Abrasions and scratches

Abrasions and scratches are of various shapes and colors but they are mostly reddish-brown if they are the result of very gentle pressures, such as is often the case with pieces of leaf between or against the fruits. Very light scratches that are several millimeters to a centimeter long and reddish-brown are often seen. When these are abundant in a small area, the discoloration is similar to red rust and maturity stain but close inspection with a hand lens discloses an easily identifiable difference. Volcanic ash, which is common from time to time, also produces abrasions and spots of the same general color.

Bee injuries

Small bees, *Trigona* spp., produce rows of small irregular pits on the ridges or ribs of the fruit. As many as 17 of such ragged gouges have been seen in a row on one ridge. They are usually 0.5 to 1 centimeter across and about 2 millimeters deep. Dried fibers stick out along the edges and the scab is grayish-brown. In some cases the scars are elongate, extending halfway across adjacent flat surfaces. The injuries are very scattered, generally not serious and inclined to be most numerous adjacent to jungles.

Scale insects

Various species of armored scales are found on the leaves from time to time and some occasionally infest fruit stocks. As many as 50 scales were counted on one fruit but this was the exception. The scales are reddish-brown and are generally considered a part of the rind discoloration. In addition, the feeding often creates a white spot around the scale covering and the location of the proboscis is indicated by a dark green line.

Other discolorations

Black spot is a small, slightly sunken spot, usually about 3 millimeters in diameter, often surrounded with a wet green coloration suggesting that a fungus organism is responsible.

It is found in nearly all groves but there is seldom enough to cause downgrading of fruit. On some green fruit there are small white spots but they are not serious and the cause is unknown. "Raton" tracks are the result of rodents running over the fruit during growth. The claw scratches leave trails or corky brown scabs about 4 to 12 millimeters long that are easily identified. Control is usually obtained by putting a bounty on the rodents. There are many other miscellaneous abrasions and discolorations which have not been mentioned, abundant from time to time, and which increase the difficulty of producing flawless fruit. These minor spots are often mixed with those that are more serious.

Summary

There are many stains, spots and discolorations of banana fruits. The injuries produced by one agent often change in appearance and color but most of them show considerable similarity. Often, fruit discoloration is the result of several or many causes. The net result is that there is some confusion about fruit spotting and much of it is incorrectly identified by growers.

Three species of thrips, namely, *Palleucothrips musae*, *Selenothrips rubrocinctus* and *Frankliniella parvula*, are directly responsible for spotting of fruit. Red rust caused by *P. musae* and scarring caused by the other two species are insignificant in comparison with maturity staining. In most cases, what is called red rust of thrips by field operators is maturity staining. Caterpillar and root borer feeding contributes to retarded growth, which is assumed to be the cause of maturity staining. Maturity staining is responsible mostly for fruit rejection, which is causing appreciable financial losses to banana growers.

World distribution of *Cercospora traversiana* [1]

E. E. Leppik, Plant Introduction Station, Iowa State University, Ames, Iowa

Cercospora traversiana Sacc. causes a destructive but little-known leaf spot disease of fenugreek (*Trigonella foenum-graecum*). Native to the Near East and India, this disease lately began to spread westward and reached several East European countries and South America. It recently also appeared in the United States, introduced with several seed samples from Ethiopia and East India. As a seed-borne disease, it frequently passes through entry quarantine stations and appears in the least expected places.

Leaf spot of fenugreek

This is a rather destructive disease of considerable economic importance. It attacks leaves, stems, young pods and seedlings, damaging the plants before they ripen. In Ames, Iowa, almost 70 percent of the plants were killed under moist greenhouse conditions. Similar heavy losses are reported from foreign countries where the disease has been observed (3, 4, 7, 10). Circulating dry air obtained by adequate ventilation, however, helped to reduce losses in the greenhouses.

Cercospora traversiana is a typical seed-borne fungus with systemic mycelium inside the host plant. It begins to develop during the germination of the seed and produces abundant conidia on the seed coat. Conidia grow vigorously in the cold and moist atmosphere. Young seedlings of fenugreek may be infected by conidia produced on the seed coat but the fungus remains long unnoticed in its host. First symptoms usually appear as large spots on leaves and stems (Figure 1) during and after anthesis. In this stage of development the disease spreads mainly from plant to plant in the field or in the greenhouse. Soon the young pods are infected and the fungus invades immature seeds. Infected seeds are not killed immediately but provide a place for overwintering of the fungus and serve as a carrier for its long-distance distribution. In seeds, the fungus is not easy to detect and is difficult to control. It is not surprising, therefore, that this disease has passed frequently through entry quarantine stations and reached distant countries, such as Estonia, Brazil and

[1] *Disease Reports from the Regional Plant Introduction Station*, Ames, Iowa, U.S.A., No. 4, 1959.

Figure 1. *Cercospora traversiana* on leaves and pods of fenugreek.

Figure 2. Distribution of *Cercospora traversiana*. Places where the fungus has been reported are indicated by dots and the native region of fenugreek is encircled.

the United States, far removed from its indigenous area (3,5).

Geographic distribution of the fungus

Cercospora traversiana was first described by Saccardo (8) on fenugreek grown in the Botanical Garden of Patavino (Patavia). Maublanc (5) later described this fungus as *C. trigonellae*, which is considered synonymous. Săvulescu and Sandu-Ville (9) described a fungus on *Trigonella coerulea* as *C. traversiana* var. *trigonellae-coeruleae*, which should be identical with *C. radiata* Fuck. f. *trifolii coerulei* Viv. Chupp (2) placed all these names under the species *C. traversiana* occurring on *Trigonella foenum-graecum* and *T. coerulea*. The fungus was known at that time from Italy, Romania, Austria and Brazil.

In addition, *Cercospora traversiana* has been found by Su (10) in Burma, Leppik (3, 4) in Estonia, Bremer *et al.* (1) in Turkey, and by Palti (7), Minz and Solel (6) in Israel.

These limited data on the distribution of the *Cercospora* disease on fenugreek can now be augmented by numerous new records on its occurrence, as detected from imported seed samples at the Iowa station. These records involve many localities in Ethiopia, Turkey, Pakistan, Afghanistan, India, Iraq, Iran, Palestine, Jordan and Greece. So far, 14 fenugreek accessions introduced from the above-mentioned countries have been found infected by *Cercospora* disease (Figure 2). Other introduced species of *Trigonella*, including *T. coerulea*, did not show the fungus on seed and remained free from infection during their growth. This fact supports the view of Săvulescu and Sandu-Ville that the fungus on *T. coerulea* is a different variety, if not a new species.

Table 1 summarizes known records on the distribution of *Cercospora traversiana*, based on the literature and on the results of analyzing seed samples at the plant introduction station at Ames, Iowa.

TABLE 1. Distribution of *Cercospora traversiana*, according to literature and analysis of seed samples of fenugreek at the plant introduction station, Ames, Iowa

Place of origin		Year of recording	Author
Italy	Padua	1903	Saccardo
Brazil	São Paulo	1914	Maublanc
Austria	Laibach	1879	Voss
Romania	Tulcea	1931	Săvulescu
Burma	Mandalay	1933	Su
Estonia	Tartu	1934	Leppik
Turkey		1952	Bremer *et al.*
Israel		1956	Palti
India	Madras	1957	Leppik
	Bombay	"	"
Pakistan	Rawalpindi	"	"
Afghanistan	Kandahar	"	"
Iran	Isfahan	"	"
Turkey	Ankara	"	"
Ethiopia	Addis Ababa	"	"
	Diredawa	"	"
India	Madras[a]	1959	Leppik
	Bombay[a]	"	"
Ethiopia	Diredawa[a]	"	"

[a] The fungus appeared abundantly on seed coat during germination.

Although the fenugreek is a very old cultivated plant in both the Old and New World, the leaf spot disease did not appear in older cultures of this plant. The first discovery of the *Cercospora traversiana* by Saccardo in Italy and later observations made by Săvulescu and others in Romania and Austria misled earlier mycologists to consider this disease as being of European origin. Recent findings, particularly from the analysis of seed samples from various countries of the Near East, India and Ethiopia, extended considerably the known area of geographic distribution of this fungus. They also indicate that *C. traversiana* must be a native of Asia Minor and that it was introduced only recently to Europe and elsewhere.

From the present study, it appears that the fungus *Cercospora traversiana*, possibly some new and particularly virulent races, has begun to spread from the Near East and may be ready to invade the American continent. It seems possible, however, to stop this invasion by adequate quarantine measures and post-entry control.

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It must be issued within 20 days before dispatch of the shipment, in the Polish language or in English, French, German or Russian, with names of diseases, pests and weeds in Latin. For the importation of seeds of flax, hemp, timothy, clover, alfalfa, serradella, vetch, sweet clover, bird's-foot trefoil and crimson clover, freedom from dodder seeds should be indicated in the certificate or in a separate declaration.

Each shipment should be contained in a container or freight car sealed with lead by the official plant protection or seed inspection service of the exporting country, except when the shipment weighs less than 20 kilograms, or when the goods are carried in bulk in the ship's hold or in open transport vehicles.

For the importation of potatoes, the containers should not be used previously.

Imports without restrictions

The following plant materials may be imported without phytosanitary certificates, without permission from the minister of agriculture and without inspection.

1. Coffee, tea, cacao, vanilla, nutmeg, bay leaves, pepper, pimento, cinnamon, ginger and cardamon.
2. Tropical fruits, such as pineapple, banana and others but excluding citrus fruits.
3. Frozen fruits and vegetables.

Prohibited diseases, pests and weeds

The following diseases, pests and weeds are listed in the appendix of the order :

Diseases

Spongospora subterranea
Synchytrium endobioticum
Tilletia controversa (*T. brevifaciens*)
Bacterium stewartii
Diplodia zeae
Mycosphaerella linorum (*Septoria linicola*)
Erwinia amylovora
Corynebacterium michiganense
Botrytis tulipae
Xanthomonas hyacinthi

Pests

Heterodera rostochiensis
Leptinotarsa decemlineata
Phthorimaea operculella
Phthorimaea ocellatella
Eriosoma lanigerum
Viteus vitifoliae (*Phylloxera vastatrix*)
Quadraspidiotus (*Aspidiotus*) *perniciosus*
Popillia japonica
Hyphantria cunea
Laspeyresia molesta *
Ceratitis capitata *
Rhagoletis pomonella *
Aphelenchoides fragariae
Tarsonemus fragariae
Calandra oryzae
Acanthoscelides obtectus
Callosobruchus maculatus

Weeds

Cuscuta sp.
Orobanche sp.

* Not applicable to fruits imported between 1 November and 31 March.

Stabilimento Tipografico Fausto Failli - Roma

EFFICIENT USE OF FERTILIZERS

FAO Agricultural Studies No. 43

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